Supporting Mastery Learning with Flexible Extensions

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ABSTRACT

Equitable grading practices and flexible deadline policies have previously demonstrated positive student learning and well-being outcomes. In this poster, we contribute a framework for flexible extension policies that emphasize equitable grading. We then analyze extension requests and grades obtained by students in a Data Science course with a flexible extension policy. We present two research questions based on this data. **RQ1:** How does the length of an extension relate to student performance on the corresponding assignment? **RQ2:** How does student extension usage across the semester relate to students' learning of the content?

KEYWORDS

Equitable grading, Flexible extension policy, Mastery learning

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1 INTRODUCTION

In a traditional classroom setting, students are subject to rigid due dates. Credit is given to students for work that is submitted in a timely manner. This system, however, tends to favor those with prior experience–students with experience tend to be more prepared and need less time to complete the assignments, leading to concerns about the equity and effectiveness of the system [1, 3].

An alternative approach, *mastery learning*, allows students to attain any grade they are willing to put in the time and effort for [3]. This often involves giving some students more time on specific assignments and incorporating an auto-grader so that students can get instant feedback on their work. Such practices allow students to master concepts more thoroughly, even if it means that they would need more time. Prior research also shows that such mastery learning practices have a positive effect on student engagement, learning progress, and final grades [2, 4]. This paper examines a data science course incorporating a mastery learning approach into its grading policies.

2 CLASSROOM DESCRIPTION

The study is conducted in a data science course intended for students with previous beginner-level programming and statistics experience, with a focus on fundamental techniques of data science. The study was performed during Spring 2023 with an enrollment of 1225 students.

Take-home assignments consisted of homework assignments, projects, and labs. Labs were short, low-stakes assignments, while homework assignments and projects were longer assignments worth a more significant percentage of student's grades. There is a pre-configured auto-grader written by the course staff for assignments involving programming. The submission platform also output the score immediately after submitting the assignment. For assignments with written questions, course staff manually graded the written portion. All auto-grader test cases for labs were visible to students, while homework and projects incorporated hidden tests.

3 POLICIES

To make mastery learning a reality, we propose a set of policies centered around flexible extensions on assignments. These policies were implemented in the data science course described in Section 2. Figure 1 provides an overview of student experience with flexible extensions in our classroom model.

To address unexpected student emergencies during the course, instructors provided an Extenuating Circumstances Google Form.

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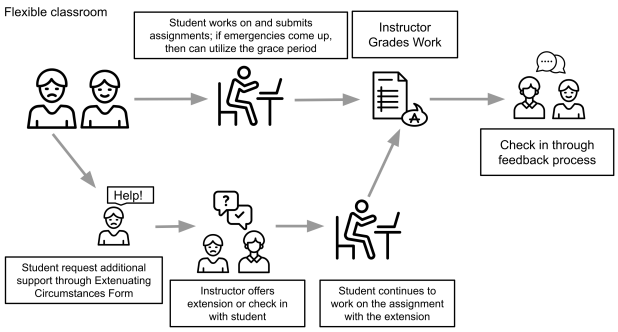

Figure 1: Student experience with flexible assignment extensions.

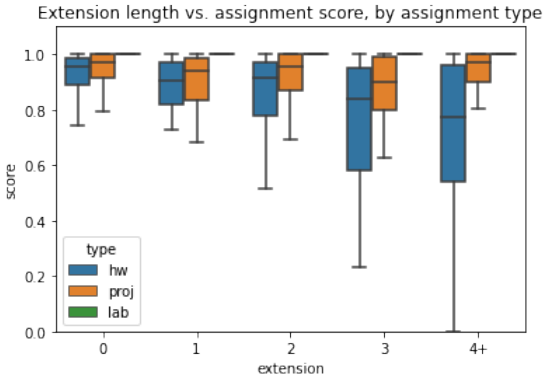

Figure 2: Association of assignment scores by extension length for different assignment types.

Students were encouraged to fill in this form to account for extenuating circumstances, such as personal health issues or family emergencies, preventing them from completing the assignment. The form asked for the assignment on which the student would like to request an extension, the reasons for the extension request, the proposed extension duration, and the student's availability in case a meeting was necessary. Students were given two days for each request unless the student explicitly requested more.

For each student's form submission, course staff approved or denied the extension request based on the reason outlined by the student and their extension request history. Email updates were then sent to students based on the decision. If a student repeatedly requested extensions on assignments, course staff reached out to schedule a 30-minute meeting to check in with the student on their learning progress, answer any questions, and provide advice.

4 RESULTS AND DISCUSSION

To address RQ1, we first examine the correlation between extension lengths and student grades on the extended assignments. Figure 2 displays the association between extension lengths and grades on corresponding assignments. For homework assignments, as extension lengths increase, the median student score on corresponding submissions tends to decrease. This trend could result from students requesting extensions on assignments they already struggled with. On the other hand, for labs, extension lengths appear to have little to no effect on student scores; most students receive near-perfect scores on labs regardless of extension length, possibly due to the visible test cases and lower difficulty of lab assignments.

To address RQ2, we evaluate the correlation between extensions across the duration of the semester and student final exam scores, using final exam performance as an indicator of student understanding of the course content. We discovered a negative correlation of -0.9 between these two variables; students requesting more extension days tend to receive lower grades on the final exam. Similarly to extensions on individual assignments, heavier use of extensions throughout the semester may indicate that students struggle with the material or with recurring extenuating circumstances impacting their learning of the content.

5 FUTURE WORK

Moving forward, we plan to build on our analysis to more clearly assess the effects of a flexible extensions policy. Our current data about student grades provides limited information about student learning gains, student well-being, and the trade-offs associated with alternative policies. Rather than just grades, we plan to analyze the results of surveys administered to students at the end of the semester. We also hope to use focus group interviews to better understand the effects on student learning and well-being, especially for students with disability accommodations and students from underrepresented groups. We would like to conduct similar analyses on different classes to compare the effects of different policies, as undergraduate data science and computer science classes incorporate various policies surrounding extensions. In particular, we would like to compare data from classes with flexible extensions to classes without extensions. This may allow us to determine the effects of an extensions policy on exam scores, grade distributions, survey results, number of students dropping the class, and other metrics of student learning gains and well-being.

We are also currently developing a tool to automate the process of granting extensions for instructors, reducing the effort involved with implementing a flexible extension policy. This tool is discussed in greater detail in a different work [5].

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